AMENDMENTS TO THE CLAIMS

This listing of claims will replace all prior versions and listings of claims in the application.

1. (currently amended) A subarray beamformer for a multi-beam phased array antenna comprising: a plurality of phased array antenna beamforming layers comprising; a first beamforming layer having a first plurality of combiners in a first orientation and combining a first set of signals to form a second set of signals; and a second beamforming layer having a second plurality of combiners in a second orientation coupled to and opposing said first plurality of combiners, said second plurality of combiners combining said second set of signals to form at least one first combined signal,

wherein said first plurality of combiners are in a first unidirectional orientation and said second plurality of combiners are in a second unidirectional orientation orthogonal to said first unidirectional orientation.

2. (canceled)

3. (original) A beamformer as in claim 1 wherein said plurality of phased array antenna beamforming layers further comprise: a third beamforming layer having a third plurality of combiners in a third orientation and combining a third set of signals to form a forth set of signals; and a forth beamforming layer having a forth plurality of combiners in a forth orientation coupled to and opposing said third plurality of combiners, said forth plurality of combiners combining said forth set of signals to form at least one second combined signal.

4. (original) A beamformer as in claim 3 wherein said third plurality of combiners are in a third unidirectional orientation and said forth plurality of combiners are in a forth unidirectional orientation orthogonal to said third unidirectional orientation.

5. (original) A beamformer as in claim 3 wherein said first beamforming layer and said forth beamforming layer are formed as a single beamforming layer.

6. (original) A beamformer as in claim 3 wherein said second beamforming layer and said third beamforming layer are formed as a single beamforming layer.

7. (original) A beamformer as in claim 3 wherein said forth beamforming layer comprises fewer combiners than said third beamforming layer.

8. (original) A beamformer as in claim 1 wherein said second beamforming layer comprises fewer combiners than said first beamforming layer.

9. (original) An assembly as in claim 1 wherein said subarray beamformer comprises fewer beamforming layers than a quantity of radiating elements coupled thereto.

10. (original) A beamformer as in claim 1 wherein said plurality of phased array antenna beamforming layers comprise approximately less than or equal to four beamforming layers.

11. (original) A beamformer as in claim 1 wherein each combiner within said first plurality of combiners and said second plurality of combiners combine signals received from each tile within a beamforming subarray of tiles.

12. (original) A subarray beamformer for a multi-beam phased array antenna comprising: a plurality of phased array antenna beamforming layers comprising; a second beamforming layer having a second plurality of dividers in a second orientation and dividing at least one first combined signal to form a second set of signals; and a first beamforming layer having a first plurality of dividers in a first orientation coupled to and opposing said second plurality of dividers, said first plurality of dividers dividing said second set of signals to form a first set of signals.

13. (original) A beamformer as in claim 12 wherein said first plurality of dividers are in a first unidirectional orientation and said second plurality of dividers are in a second unidirectional orientation orthogonal to said first unidirectional orientation.

14. (original) A beamformer as in claim 12 wherein said plurality of phased array antenna beamforming layers further comprise: a forth beamforming layer having a forth plurality of dividers in a forth orientation and dividing at least one second combined signal to form a forth set of signals; and a third beamforming layer having a third plurality of dividers in a third orientation coupled to and opposing said forth plurality of dividers, said third plurality of dividers dividing said forth set of signals to form a third set of signals.

15. (original) A beamformer as in claim 14 wherein said third plurality of dividers are in a third unidirectional orientation and said forth plurality of dividers are in a forth unidirectional orientation orthogonal to said third unidirectional orientation.

16. (original) A beamformer as in claim 14 wherein said first beamforming layer and said forth beamforming layer are formed as a single beamforming layer.

17. (original) A beamformer as in claim 14 wherein said second beamforming layer and said third beamforming layer are formed as a single beamforming layer.

18. (original) A beamformer as in claim 14 wherein said forth beamforming layer comprises fewer dividers than said third beamforming layer.

19. (original) A beamformer as in claim 12 wherein said second beamforming layer comprises fewer dividers than said first beamforming layer.

20. (original) An assembly as in claim 12 wherein said subarray beamformer comprises fewer beamforming layers than a quantity of radiating elements coupled thereto.

21. (original) A beamformer as in claim 12 wherein said plurality of phased array antenna beamforming layers comprise approximately less than or equal to four beamforming layers.

22. (original) A beamformer as in claim 12 wherein each divider within said first plurality of dividers and said second plurality of dividers divide signals for each tile within a beamforming subarray of tiles.

23. (original) A multi-beam phased array antenna assembly comprising: a plurality of radiating elements receiving a plurality of beams having a first set of signals; a common structure coupled to said plurality of radiating elements; a plurality of signal conditioners coupled to said common structure; and a subarray beamformer coupled to said plurality of signal conditioners and comprising; a plurality of phased array antenna beamforming layers comprising; a first beamforming layer having a first plurality of combiners in a first orientation and combining said first set of signals to form a second set of signals; and a second beamforming layer having a second plurality of combiners in a second orientation coupled to and opposing said first plurality of combiners, said second plurality of combiners combining said second set of signals to form at least one first combined signal.

24. (original) An assembly as in claim 23 further comprising a cover coupled to said subarray beamformer.

25. (original) An assembly as in claim 23 wherein said plurality of phased array antenna beamforming layers further comprise: a third beamforming layer having a third plurality of combiners in a third orientation and combining a third set of signals to form a forth set of signals; and a forth beamforming layer having a forth plurality of combiners in a forth orientation coupled to and opposing said third plurality of combiners, said forth plurality of combiners combining said forth set of signals to form at least one second combined signal.

26. (original) An assembly as in claim 23 wherein said subarray beamformer comprises fewer beamforming layers than a quantity of radiating elements within said plurality of radiating elements.

27. (original) An assembly as in claim 23 wherein said plurality of phased array antenna beamforming layers comprise approximately less than or equal to four beamforming layers.

28. (original) An assembly as in claim 23 wherein said plurality of phased array antenna beamforming layers comprise approximately two beamforming layers.

29. (original) A multi-beam phased array antenna assembly comprising: a plurality of radiating elements transmitting a plurality of beams having a first set of signals; a common structure coupled to said plurality of radiating elements; a plurality of signal conditioners coupled to said common structure; and a subarray beamformer coupled to said plurality of signal conditioners and comprising; a plurality of phased array antenna beamforming layers comprising; a second beamforming layer having a second plurality of dividers in a second orientation and dividing at least one first combined signal to form a second set of signals; and a first beamforming layer having a first plurality of dividers in a first orientation coupled to and opposing said second plurality of dividers, said first plurality of dividers dividing said second set of signals to form said first set of signals.

30. (original) An assembly as in claim 29 further comprising a cover coupled to said subarray beamformer.

31. (original) An assembly as in claim 29 wherein said plurality of phased array antenna beamforming layers further comprise: a forth beamforming layer having a forth plurality of dividers in a forth orientation and dividing at least one second combined signal to form a forth set of signals; and a third beamforming layer having a third plurality of dividers in a third orientation coupled to and opposing said forth plurality of dividers, said third plurality of dividers dividing said forth set of signals to form a third set of signals.

32. (original) An assembly as in claim 29 wherein said subarray beamformer comprises fewer beamforming layers than a quantity of radiating elements within said plurality of radiating elements.

33. (original) An assembly as in claim 29 wherein said plurality of phased array antenna beamforming layers comprise approximately less than or equal to four beamforming layers.

34. (original) An assembly as in claim 29 wherein said plurality of phased array antenna beamforming layers comprise approximately two beamforming layers.

35. (original) A satellite having a multi-beam phased array antenna assembly comprising; a plurality of radiating elements receiving a plurality of beams having a first set of signals; a common structure coupled to said plurality of radiating elements; a plurality of signal conditioners coupled to said common structure; and a subarray beamformer coupled to said plurality of signal conditioners and comprising; a plurality of phased array antenna beamforming layers comprising; a first beamforming layer having a first plurality of combiners in a first orientation and combining said first set of signals to form a second set of signals; and a second beamforming layer having a second plurality of combiners in a second orientation coupled to and opposing said first plurality of combiners, said second plurality of combiners combining said second set of signals to form at least one first combined signal.

36. (original) A satellite as in claim 35 wherein said subarray beamformer comprises fewer beamforming layers than a quantity of radiating elements within said plurality of radiating elements.

37. (original) A satellite having a multi-beam phased array antenna assembly comprising: a plurality of radiating elements transmitting a plurality of beams having a first set of signals; a common structure coupled to said plurality of radiating elements; a plurality of signal conditioners coupled to said common structure; and a subarray beamformer coupled to said plurality of signal conditioners and comprising; a plurality of phased array antenna beamforming layers comprising; a second beamforming layer having a second plurality of

dividers in a second orientation and dividing at least one first combined signal to form a second set of signals; and a first beamforming layer having a first plurality of dividers in a first orientation coupled to and opposing said second plurality of dividers, said first plurality of dividers dividing said second set of signals to form said first set of signals.

38. (original) A satellite as in claim 37 wherein said subarray beamformer comprises fewer beamforming layers than a quantity of radiating elements within said plurality of radiating elements.

39. (original) A method of forming a multi-beam phased array antenna assembly comprising: manufacturing a common structure configured to couple a plurality of radiating elements to a plurality of signal conditioners; coupling a beamforming board to said plurality of signal conditioners; and encasing said plurality of signal conditioners and said beamforming board in said common structure.

40. (original) A method as in claim 39 further comprising coupling a plurality of tile elements between said plurality of radiating elements and said beamforming board and within said common structure.